

ACCESSION #: 9612090308
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Grand Gulf Nuclear Station, Unit 1 PAGE: 1 OF 5

DOCKET NUMBER: 05000416

TITLE: Manual Reactor Scram Due to Spurious Multiple SRV Lifts

EVENT DATE: 06/06/96 LER #: 96-004-01 REPORT DATE: 12/04/96

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
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Engineer

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

At 1126 on June 6, 1996, GGNS experienced an opening Of Six Main Steam Safety/Relief Valves (SRV) which resulted in an increase in suppression pool temperature. The reactor was manually scrambled by control room operators before temperature limits were reached. The cause of the SRV lifts was the failure of a capacitor on a card supplying power to the logic train which caused a momentary voltage spike sufficient to initiate the Division 11 logic for the SRVs in addition to the logic for the low-low set SRVs. Six SRVs opened due to the seal-in feature of low-low set. Following the manual scram, the six SRVs closed sequentially as reactor pressure decreased.

Initial short-term corrective actions included troubleshooting/replacing the trip unit card in addition to functionally checking the other card files in the same panel. A material nonconformance report was generated to document the failure of the capacitor on the failed trip unit. Long-term corrective actions are to evaluate improvements to the low-low set function (which is not single-failure proof) to improve the reliability of the SRV function, perform a failure analysis on the failed trip unit card and review generic

implications for similar circuit logic issues.

Failure analysis performed on the trip unit indicated the most likely cause of the failure to be the shorting of the capacitor.

This event is reportable pursuant to 10CFR50.73(a)(2)(iv). Although the Emergency Core Cooling System (ECCS) was available to perform its safety function, ECCS injection was not required during the event. The health and safety of the general public were not compromised as a result of this event.

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A. Reportable Occurrence

A reactor scram was manually initiated on June 6, 1996, due to increasing suppression pool temperatures caused by the discharging of six Main Steam Safety/Relief Valves (SRVs). Since the SRVs and the low-low set function is not an Engineered Safety Feature (ESF) [JE] System, their opening is not considered an ESF actuation. This event did result in the manual actuation of the Reactor Protection System (RPS) and is, therefore, reportable pursuant to 10CFR50.73(a)(2)(iv).

B. Initial Conditions

At the time of the event, the reactor was in OPERATIONAL CONDITION 1 with reactor power at approximately 100 percent. Reactor temperature, reactor pressure vessel (RPV) pressure and RPV water level were at approximately 540 degrees F, 1045 psig and 36 inches, respectively. There were no surveillances nor maintenance activities in progress with the potential for causing the event nor was there indication of reactor pressure increasing at the onset of the event.

C. Description of Occurrence

At 1126 on June 6, 1996, a manual reactor scram was inserted in both divisions of RPS resulting in a full reactor scram. The scram was initiated by control room operators due to the opening of six SRVs which resulted in rising suppression pool temperatures.

In panel 1H13P618, a trip unit card failed causing fuse E12-F38 to open. Fuse E12-F38 provides 24 volts DC to card file Z5 which contains various Rosemount master and slave trip units. The card failure generated a momentary voltage spike on the common power supply feeding the associated control circuitry for the Division 11

SRV logic. Although very short in duration, this voltage spike was sufficient to initiate the Division II logic for the SRVs in addition to the logic for the low-low set SRVs. The trip units providing both halves of the required two-of-two logic for the SRVs are located in card file Z8 of panel 1H13P618. Trip units in all four safety related card files in panel 1H13P618 are supplied power via a single 24 volt DC power supply.

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C. Description of Occurrence (cont'd)

Parameter Display System data indicates that all 20 SRVs received a momentary open signal and that the logic was actuated for approximately 200 milliseconds. Fourteen non low-low set SRVs did not receive a sustained open signal. However, due to the seal-in feature of low-low set and because the low-low set function is not single-failure proof, six of the SRVs remained open.

The six low-low set SRVs controlled reactor pressure at a lower setpoint by discharging to the suppression pool. This caused an increase in suppression pool temperature to approximately 105 degrees F at which time the manual scram was inserted to prevent the Technical Specification temperature limit of 110 degrees F from being reached.

Following the manual scram, the six SRVs closed sequentially as reactor pressure decreased. Level was restored to normal range using condensate/feedwater [SD/SJ] while reactor pressure was controlled using turbine bypass [JI] valves. Both loops of suppression pool cooling were placed in service in accordance with emergency procedures for suppression pool temperature control.

Subsequent to the scram, it became apparent that the FSAR description of the low-low set function could be misinterpreted. Although the Grand Gulf licensing history clearly demonstrates NRC's acknowledgment and understanding that the low-low set function is not single-failure proof (e.g., NUREG 0802), differing interpretations of the term "logic" can lead to contrary conclusions when reviewing FSAR section 7.3.1.1.1.4.12.9.

D. Apparent Cause

The cause of the event was failure of Rosemount trip unit card 1C11N655B which caused fuse E12-F38 for card file Z5 to open. Failure of the trip unit card caused a momentary voltage spike on

the common power supply to the Division II SRV logic. The voltage spike caused a spurious sensed high reactor vessel pressure signal which initiated the Division II logic for the SRVs including the logic for the six low-low set SRVs.

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D. Apparent Cause (cont'd)

Failure analysis of the Model 510DU7A005 slave trip unit indicated extensive burn damage to capacitor C25, inductor L1 and diode CR1. Microscopic examination showed the most extensive damage had occurred to capacitor C25. Approximately 50% of the capacitor had melted and flowed onto surrounding components. L1 inductor, CR1 diode and several current traces also showed burn damage. It was concluded that the extent of the damage would not allow meaningful component level analysis on any of the damaged components. However, circuit analysis identified the most likely cause of failure to be the shorting of the C25 capacitor.

Since the low-low set function is not single-failure proof, a contributing cause to the event is the non-optimum design of the function. While the design comports to the license/design basis of the plant and leads to acceptable nuclear safety results, it does not contribute to optimum plant availability/reliability.

E. Corrective Actions

Initial short-term corrective actions included:

- o Troubleshooting confirmed the cause of the voltage spike and confirmed the failure.
- o The failed trip unit, 1C11N65513, was replaced and tested.
- o The remaining Z5 card file trip units were individually inspected and functionally checked. All results were satisfactory.
- o A material nonconformance report (MNCR) was generated to document the failure of the capacitor on the failed trip unit.

Long-term corrective actions are:

- o Engineering Request (ER) 96/0514-00 Rev. 0 was issued and implemented during Refueling Outage Eight. This ER provided

separate power supplies for each of the four channels of SRV trip units. The SRV solenoids require a two-out-of-two logic with either division for operation. By separating each channel, inadvertent actuation due to a single power supply perturbation is precluded.

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E. Corrective Actions (cont'd)

- o Trip unit 1C11N655B was shipped to the manufacturer for failure analysis.
- o Clarify FSAR section 7.3.1.1.4.12.9 to clearly indicate that the low-low set function (vice the low-low set logic) is not single-failure proof.
- o Review generic implications for similar circuit logic power supply issues.

F. Safety Assessment

This event did not impair the ability of any system to perform its intended safety function. Although the Emergency Core Cooling System (ECCS) was available to perform its safety function, ECCS injection was not required during the event. All safety systems functioned as designed, and no abnormalities were observed. As designed, six of twenty SRVs actuated on low-low set logic during the plant transient.

Since all design features and limits were preserved with adequate margins and no equipment operated beyond analyzed design limits, the overall safety significance of this event was negligible. The health and safety of the general public were not compromised as a result of this event.

G. Additional Information

Although previous spurious trips of the low-low set logic have occurred during maintenance and surveillance activities, prior corrective actions have been successful in eliminating those types of trips. No SRV actuations due to maintenance or testing have occurred since January 15, 1990. The June 6, 1996 event, which was unrelated to maintenance/surveillance activity, is the first involving a component failure causing a power supply voltage spike leading to actuation of the low-low set logic.

As a result of this event, Incident Report 96-06-01, MNCR 0097-96 and Root Cause Analysis Report RCDL#96-14 were generated. Energy Industry Identification System (EIIS) codes are identified in the text within brackets [].

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Joseph J. Hagan
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December 4, 1996

U.S. Nuclear Regulatory Commission
Mail Station P1-137
Washington, D.C. 20555

Attention: Document Control Desk

SUBJECT: Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416
License No. NPF-29
Update to Manual Reactor Scram Due to Spurious Multiple
SRV Lifts
LER 96-004-01

GNRO-96/00133

Gentlemen:

Attached is Licensee Event Report (LER) 96-04-01 which is a final report.

Yours truly,

JJH/CDH
attachment LER 96-004-01
cc: Mr. R. B. McGehee (w/a)
Mr. N. S. Reynolds (w/a)

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